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NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT

NBS REPORT

1002-30-10628

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FIRE ENDURANCE TESTS

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DULKHEAD ASSEMBLIES

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J. V. Ryan

for

U. S. Coast Guard

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U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS



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V. CANTERED FASSEMBLIES SECRET PLANT FALLERS

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five bulkhead assemblies were subjected to fire tests. Each specimen was made of 3/4 in. thick marine board with a vertical joint and steel joint member. The members were of the same design in all specimens, but the marine boards differed. The defined limiting temperature rise was reached in from 12.6 to 16.2 min for the various specimens. All served as barriers to the passage of flames throughout the 60-min tests.

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At the request of the U. S. Coast Guard (letter of 22 March 1960), five bulkhead assembly specimens were subjected to fire tests in compliance with Subpart 164.008-3(b) of Specification for Pulkhead Fanels for Merchant Vessels.

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The specimens were submitted by, and shipped from, Dansk Eternit-Fabrik A/S, Aalborg, Denmark. The specimens and shipping container were received in good condition. The specimens were identified as follows:

- Navilite 36, type V-22 both sides plain finish, 3/4 in. thick, proposal 2.
- 2. Navilite 36, type Z-22, both sides plain finish, 3/4 in. thick, proposal 2.
 - 3. Navilite 35, type 755, both sides veneered with hard Top, 3/4 in. thick, proposal 1.

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Five balkased easembles were subjected to, its tests. Each specimen was made of 3/4 in. which easing board with a vertical joint and this etael joint amber. The sembers were of the same design to all specimens, but the asrine boards differed. The defined limiting temperature rise was recoined in from 13.5 to 16.2 min for the various specimens. All served as services to the passage of flames throughout the 50-min tests.

1. Introduction

At the request of the U. 3. Coast duard (letter of 22 March 1960), flyo bulkhest essembly specimens were subjected to fire tests in compliance with subpart 104.008-3(b) of Specification for Sulmised Panels for Serbant Vessia.

2. Test Speciacus

The specisons were submitted by, and sulpped from Dansk aternit-Rabrik a/S, halborg, Dansark. The specisons and shipping container were received in good condition. The specisons were identified as follows:

- 1. Wavilite 36, type V-22 both sides plain finish,
 - 2. Mavilite 36, type 1-22, both aides plain finish; 3/4 in. thick, proposel 2,
 - 3. Savilite 36, type 155, both sides venessed with dard Top, 3/4 in. thick, proposel 1.

- 4. Navilite 42, type K-22, both sides plain finish, 3/4 in. thick, proposal 1.
- 5. Havilite 48, type K-22, both sides plain finish, 3/4 in. thick, proposal 2.

The proposal numbers refer to alternate details at the top of the specimen. These and other details are shown in Figure 1, at the end of this report. The specimens were received assembled; therefore, the details are based primarily on examination after test.

In general appearance, each specimen consisted of two panels of marine board with a vertical joint member, all mounted in a frame. The joint member and frame were of steel; and were assembled to allow for movement due to thermal expansion. The marine boards were moderately hard, white, and appeared to be of cement-asbestos. Those for specimen 3 had a veneer of very hard smooth material on each face.

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The specimens were mounted in the three openings of a test frame modified to permit the simultaneous fire exposure of three bulkheads in the wall test furnace. Bulkheads 1, 2, and 3 were tested together in the first test (414); 4, 5, and a filler were tested together in the second test (415). Care was taken that each specimen was restrained against vertical movement, so that the only relief for thermal expansion was that provided for in the design and fabrication of the specimen. The peripheral joints between the specimens and the test frame were sealed with a fillet of plaster on the side to be exposed to fire. This plaster fillet covered all the metal members except that along the prescribed vertical joint between the panels of Navilite boards. Eight thermocouples were placed on the unexposed surface of each specimen, distributed as shown in the figures. The junction and several inches of the wires of each thermocouple were covered by a 6- by 6- by 0.4-in. felted asbestos pad. Twelve thermocouples, encased in porcelain insulators and iron pipes, were distributed within the furnace chamber. The furnace fires were controlled to produce average furnace temperatures as close as feasible to those of the standard time-temperature curve of ASTM Ell9, which include: 1000°F at 5 min, 1300° at 10 min, 1550°F at 30 min, 1700°F at 1 hr.

- 4. Mavilite 42, type E-22, both sides plain finish,
- 5. Navilite 48; type K-22, both sides plain finish, 3/4 in. thick, proposel 2.

The proposal numbers refer to alternate datalis at the top of the specimen. These and other details are shown in Figure 1, at the end of this report. The specimens were received ascendied; therefore, the details are based primarily on examination after test.

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The specimens were mounted in the simulations fire exposure test frame modified to permit the simulations fire exposure of three bulkheads in the well test furnace. Fulkheads i, and 2 were tested together in the first test (%10) %, 5, and 3 were tested together in the first test (%10) %, 5, and a were tested together in the weeks test (%10).

Let as taken that each apecimen was restraized against vertical sovement, so that the easy relief for therest sequencies was that provided for in the sealest and frest provided for in the secton of the speciment. The performance sected with a fillet of plates on the side to be exposed to fire. This plates fillet of plates of the along the metal sections from the file to be exposed to fire. This plates fillet of plates of the metal joint between the result of last along the prescribed formance were plated as the unsured sections from the verte section in the figures. This plates of each testacompies were plated as here it is a the fire peach the fire section to the section of the verte of the verte of the verte of the section insulators and the fire verte distributed within the firesce obscauer. The firescent test verte distributed within the firesce of the straked to make the firescent test sections of the straked to make the firescent the straked to make the firescent the straked firescent tester controlled to produce a vertage furnace at the firescent the straked to make the firescent the straked to straked to straked the straked to straked to straked the s

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Both tests were witnessed by Mr. Paul Gibson, USCO, Washington, D. C. and personnel of the National Bureau of Standards, Fire Protection Section.

4.1 Test 414

The test of specimens 1, 2, and 3 was conducted on april 7, 1960. The hard veneer exposed surface of specimen 3 (Mavilite 36, type V55) spalled at 2 min, leaving about half the original material in scattered pieces over the exposed area. This was followed by brief flaming over the spalled areas. Smoke came through the joint of specimen 3 at 21 min. The test was stopped at 1 hr. There had been no cracking of the unexposed surface of any of the specimens. The condition of the specimens after test is shown in Figures 2 and 3.

The time at which the limiting 250°F rise was reached at the highest reading thermocouple on the unexposed surface of the marine board of each specimen, as well as the maximum deflection at the center of each, is given in the following table:

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				1		100
AF CAT	and feet					1 0
	rise;			12.6	13.1	6.2
MEA U	eflecti	Oh, Li	4.	1.25	10 - June 19 - J	1.25

- see Specimen

The fire exposure severity was 101.5 per cent. No flames passed through any of the three specimens. Additional temperature data are presented in Figure 1. The temperatures from the joints were averaged separately from those on the Bavilite boards.

4.2 Test 415

The test of specimens 4 and 5 was conducted April 14,1960. Except for deflection due to bowing of the steel members, discoloration of the paint on the latter, and slight smoking from the joints over a 4-min period, there were no observable changes during the 1-hr test. There was no cracking of the unexposed surface of either specimen. The conditions of the specimens after test were essentially the same as those of specimens 1 and 2, shown in Figures 2 and 3.

h. Results

Soin tests were idinaged by Mr. Faul Cibern, USCO. Washington, B. C. and personnel of the Metional Stress of

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The test of aportains 1. 2, and 3 and conducted on Agral P. 1860. The hard vencer engaged surface of specimen Juods galveef , alm 2 is bellage (20v equi , de eilliven) & - se add tevo seceis begaines at intrope imminire and lich Limited 2 and 3.

at the nighest regular therecourie en the unaccess surface of the marine board of each appointer, as well as the maximum deflection at the nester of each, is given in the following

Tables

1 250 Fise time, sin. 12.6 13.1 16.2

250 Fise time, sin. 12.6 13.1 16.2

250 Fise time, sin. 1.25 0.5 1.25

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4.2 Test 415

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250°F rise; time, min. 14.3 12.6
Max deflection, in. 1.75 1.0

the fire an esure severity was 95.7 per cent. In figure passed through either specimen. Additional togenature data are presented in Figure 1. The temperatures from the joints were averaged separately from those on the lavility occurs.

5. Summery

The results of the two tests, involving five bulk had specimens, indicated that each remained an effective agricate the passage of flams throughout the lar test durations. The limiting temperature rise of 150% at any thermocounts, except those on the joint members, was reached in from 12.6 to 16.2 min, for the various specimens.

ince the worst applies ocross the tops of the sections were covered with plaster, in order to seal the joints between specimens and furnece frame, it is not practical to attempt comparisons between the alternate details represented by the two proposals. Nowever, even if the plaster scal had been contited, comparison would not be practical because the ochevier mear the edges of fire test specimens is ignored as a matter of the standard test method.

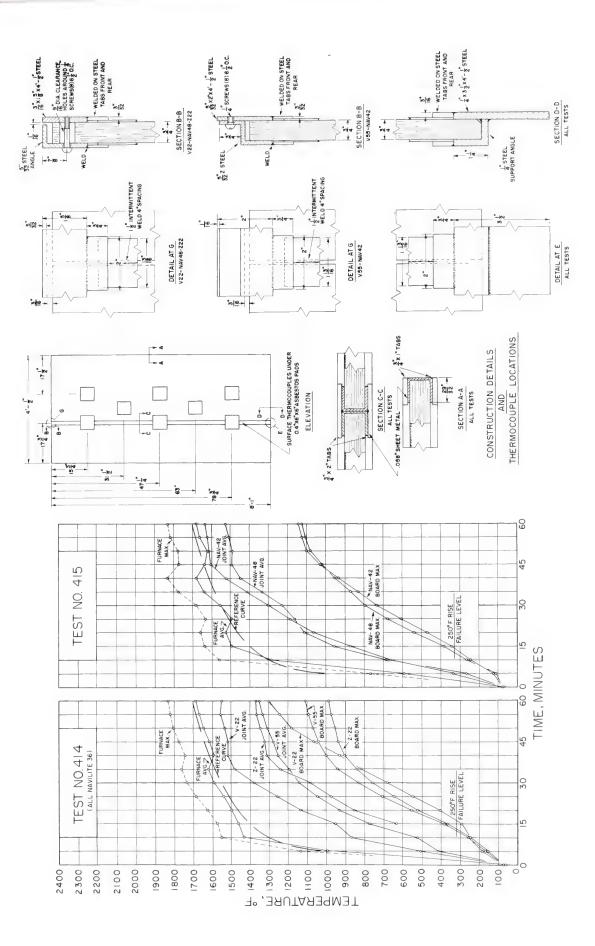
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inter 2. The transfer surface at end of test 414; and 3 from left to right.



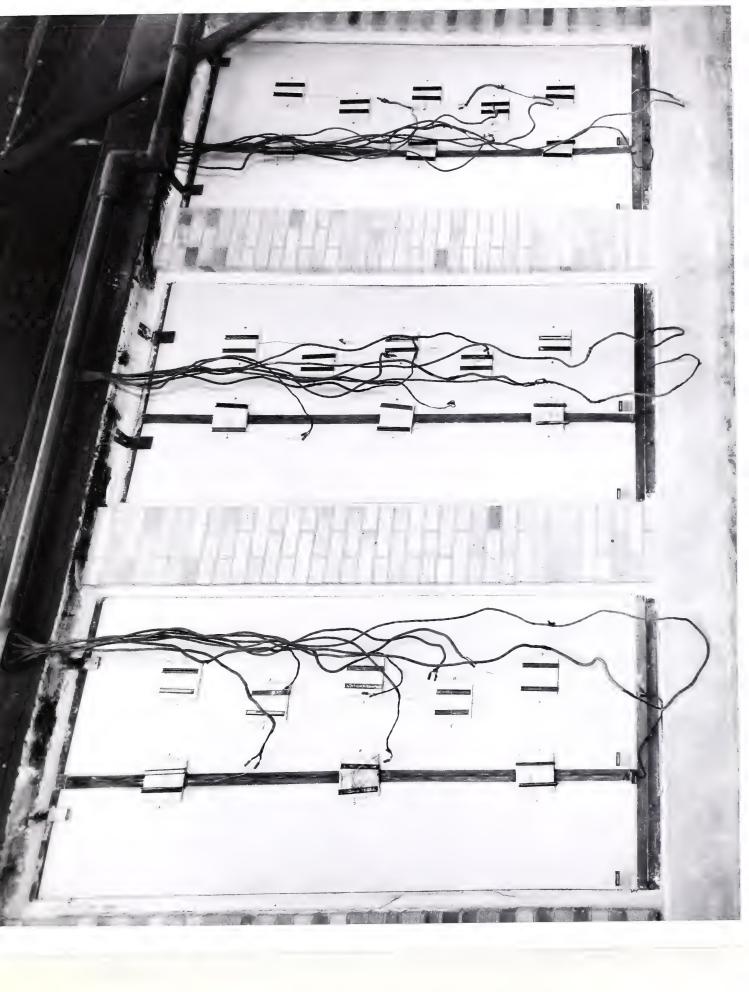


Figure 3. Loosed surface after test with specimens 1, 2, and 3 from right to left. The surface of specimen 3 specimens 1 and 2 developed during cooling and did not entend through to the unexposed surface.







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